**Freshwater Pollution Testing**

**Background**

Water is an essential resource for all life forms. In fact, water is the main component in cells and it composes up to 60-70% of the weight of living organisms. It is used for almost every activity in today’s world. Some examples are seen in agriculture and industrial applications, drinking, transportation, and recreation. Water often seems to be available in an almost endless supply, but as human populations rise and our world becomes increasingly industrialized, more and more water is being used. With this extensive use of water a problem arises: the water becomes polluted and contaminated. This pollution leads to a strain on water’s ability to recycle and cleanse itself of contaminants. The amount of water available, its distribution, and its quality are critical issues that continue to affect all life. An increasing awareness of the need to monitor the quality of water and to locate the sources of pollution is becoming more prevalent in today’s society.

There are two main types of water pollution – point specific pollution and nonpoint pollution. Point specific pollution is contamination that comes from a specific location. An example of point specific pollution is a factory that has a chemical discharge pipe that leads directly to a water source. This type of pollution can be pinpointed and limited much more readily than the second class of pollutants, nonpoint sources.

Nonpoint water pollution does not come from a specific location. Some examples are runoff of water from city areas, agricultural land, or from poor forestry practices. This type of pollution occurs when runoff water such as snowmelt or rainfall travels over an area of land. As this water moves over the ground, it picks up waster and carries it to a body of water. This water then enters our stream, lakes, rivers, and ponds.

As polluted water enters the groundwater supply or any other water source, the concentrations of certain chemicals may alter the water’s purity. In this activity, the levels of some major factors that lead to the pollution of streams, lakes, rivers, and ponds will be measured and studied. The actual amount of pollutant in these water sources plays a vital role in the biodiversity of aquatic organisms in nature. If level of pollutants reaches certain levels, the ability of specific organisms to reproduce and thrive is greatly damped and in some cases even halted. If levels of pollutants becomes too highly concentrated, and certain species of individuals become scarce or even extinct, food chains could be altered. This, in turn, could change the structure of ecosystems as we know them today. The following is a list of some common pollution indicators and how they commonly affect our water sources.

***Chlorine*** – Chlorine is not naturally found in water at any appreciable levels. It is municipally added to public water systems and swimming pools as a bactericide. Chlorine in drinking water supplies is generally maintained under 0.75 parts per million. Large levels of chlorine introduced to stream, lakes, rivers, and ponds can be harmful and possibly fatal to aquatic organisms.

***Dissolved Oxygen*** – The concentration of dissolved oxygen is one of the most important indicators of the overall health of a body of water. Water with consistently high levels of dissolved oxygen (6 parts per million or more) typically supports the most diverse biological communities. Water with consistently low dissolved oxygen levels (below 3 parts per million) is extremely stressful to aquatic organisms and may be virtually void of aquatic life or may harbor only a few species adapted to such conditions. Dissolved oxygen levels below 2 parts per million will not support fish life.

***Nitrate*** – Nitrates accumulate from decaying vegetation from the atmosphere, from fertilizers used in agriculture, animal excrements, and sewage. Unpolluted water generally has an overall nitrate level less than 4 parts per million. If the concentration of nitrogen reaches more than 10 parts per million, water may be unfit to drink. Water high in nitrates cause the overgrowth of algae and other organisms, which will foul the water found in our water sources.

***Phosphate*** – Phosphate originates from fertilizers, wastewater or domestic origin such as human, animal and plant residue, and from wastewaters of industrial origin. Phosphates are added to farm and city water systems to control water hardness. Phosphates from laundry detergents can result in over growth of algae, which in turn will cause the algae to die at a high rate and undergo decomposition. This decomposition process depletes oxygen from the water and will result in increase fish kill. Phosphate levels of more than 0.03 parts per million may lead to an overgrowth of aquatic plants.

***pH*** – The pH test is a standard test used during water analysis. pH refers to the relative abundance of hydrogen ions in a water sample. The pH scale has a range of 0 to 14 where 7 in neutral, values lower than 7 are acidic and values greater than 7 are basic. Most aquatic organisms require a pH range between 6.5 and 8.2. Water with abundant algae and vegetation growth usually has a significantly high pH. This is due to the fact that rapidly growing algae and vegetation remove carbon dioxide from the water during photosynthesis.

**Prelab Questions**

1. What are the two main types of water pollution? Define each type and list examples.
2. List possible sources and effects of each of the pollutants in this activity.

**Procedure**

***Part 1 – Chlorine Test***

1. Fill the water sample tube to 5 mL line with the freshwater sample.
2. Add one Chlorine DPD #4R TesTab to the tube.
3. Cap the tube and mix the solution until the tablet has dissolved.
4. Compare the color of the sample to the Chlorine color comparison chart.
5. Record the finding as parts per million in the data table.
6. Poor contents of the test tube down the drain.
7. Rinse the water sample tube twice with the water sample for the next test.

***Part 2 – Dissolved Oxygen Test***

1. Fill a dissolved oxygen test vial to overflowing with the freshwater sample.
2. Add two dissolved oxygen TesTabs to the test tube.
3. Cap the tube and be sure that there are no air bubbles in the sample.
4. Invert the tube and mix until the tablets have dissolved.
5. Wait for five minutes
6. Compare the color of the sample to the Dissolved Oxygen color chart.
7. Record findings as parts per million in the data table.
8. Poor the contents of the test tube down the drain.

***Part 3 – Nitrate Test***

1. Fill the water sample tube to the 5 mL line with freshwater sample
2. Add one Nitrate Wide Range TesTab to the tube.
3. Cap the tube and mix until the tablet has dissolved.
4. Wait for five minutes.
5. Compare the color of the sample to the Nitrate color comparison chart.
6. Record the findings as parts per million in the data table.
7. Poor contents of the test tube down the drain.
8. Rinse the water sample tube twice with the water sample for the next test.

***Part 4 – Phosphate Test***

1. Fill the water sample tube to the 5 mL line with the freshwater sample.
2. Add one Phosphorus TesTab to the tube.
3. Cap the tube and mix until the tablet has dissolved.
4. Wait five minutes.
5. Compare the color of the sample to that Phosphate color comparison chart.
6. Record the findings as parts per millions in the data table.
7. Poor contents of the test tube down the drain.
8. Rinse the water sample tube twice with the water sample for the next test.

***Part 5 – pH Test***

1. Fill the water sample to the 10 mL line with the freshwater sample.
2. Add on pH Wide Range TesTab to the tube.
3. Cap the tube and mix until the tablet has dissolved.
4. Compare the color of the sample to the pH color comparison chart.
5. Record the findings in the data table.
6. Poor contents of the test tube down the drain.
7. Rinse the water sample tube twice with clean water.

**Data Table**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Test Results** | | | | | | | |
| **Sample** |  |  |  |  |  |  |  |  |
| Chlorine |  |  |  |  |  |  |  |  |
| Dissolved Oxygen |  |  |  |  |  |  |  |  |
| Nitrate |  |  |  |  |  |  |  |  |
| Phosphate |  |  |  |  |  |  |  |  |
| pH |  |  |  |  |  |  |  |  |

**Analysis**

1. Compare and contrast your test results with the values given in the Background section of the lab.
2. What can be done to help minimize the amount of each pollutant in your local sources of water? Give some specific examples.
3. Would you describe your tested water source as polluted or non-polluted? Defend your answer.
4. Get the results of your classmates’ tests. Compare your values to your classmates’ values for each of the pollutants. How do your classmate’s test compare to yours?
5. Would you describe the other tested water sources as polluted or non-polluted? Defend your answer for each.
6. Which water sample(s) do you think would be best for using with plants? Why? (Remember: think about plant needs and what can hurt and help plants!)